

Chapter 8

Pollutant Loading Calculations

This chapter describes the Simple Method for determining pre- and post-development pollutant loadings from a project. It provides the event mean concentrations (EMCs) of pollutants for each land use type, and the pollutant removal efficiencies of various BMPs. This chapter also provides a link to the NHDES Simple Method Spreadsheet. Detailed calculations and guidance on running the Simple Method are described in the NHDES Interim Guidance for Estimating Pre- and Post-Development Stormwater Pollutant Loads, available from NHDES.

At this time, NHDES requires pollutant loading analysis to include only total suspended solids (TSS), total phosphorus (TP), and total nitrogen (TN). Although projects may have other pollutants of concern, TSS, TP, and TN will be used as surrogates for other parameters until such time that additional data becomes available to sufficiently and confidently model other parameters.

8-1. The Simple Method

Many models are available to estimate pre- and post-development pollutant loads, such as the STEPL, AVGWLF, WINNSLAMM, and the P8 Urban Catchment Model. Each model varies in strengths and weaknesses. NHDES is reviewing various models and will consider the use of other models if proposed. At this time, however, NHDES recommends using the “Simple Method”, a spreadsheet based calculation, for comparing pre-development to post-development pollutant loads. This section has been adapted from the Stormwater Center’s The Simple Method to Calculate Urban Stormwater Loads and describes the Simple Method loading analysis.

Simple Method Calculations

The Simple Method estimates pollutant loading of stormwater runoff for urban and developing areas. The technique is recommended by NHDES because of the modest amount of information it requires, which includes subwatershed drainage area and impervious cover, annual precipitation, and stormwater runoff pollutant concentrations.

Calculation for Chemical Constituents

The Simple Method estimates pollutant loads for chemical constituents as a product of annual runoff volume and pollutant concentration using the following equation:

$$L = 0.226 * R * C * A$$

Where:

- L = Annual loads (lbs)
- R = Annual runoff (inches)
- C = Pollutant concentration (mg/l)
- A = Area (acres)
- 0.226 = Unit conversion factor

Calculation for Bacteria

For bacteria, the equation is different, to account for the difference in units. The equation for bacteria is:

$$L = 1.03 * 10^{-3} * R * C * A$$

Where:

- L = Annual loads (Billion Colonies)
- R = Annual runoff (inches)
- C = Bacteria concentration (col/100ml)
- A = Area (acres)
- $1.03 * 10^{-3}$ = Unit conversion factor

Calculation for Annual Runoff

The Simple Method calculates annual runoff as a product of annual runoff volume, and a runoff coefficient (Rv). Runoff volume is calculated as:

$$R = P * P_j * Rv$$

Where:

- R = Annual runoff (inches)
- P = Annual rainfall (inches)
- P_j = Fraction of annual rainfall events that produce runoff (usually 0.9)
- Rv = Runoff coefficient

Calculation for Runoff Coefficient

In the Simple Method, the runoff coefficient is calculated based on impervious cover in the subwatershed. This relationship is shown in Figure 8-1. Although there is some scatter in the data, watershed imperviousness does appear to be a reasonable predictor of Rv. The following equation represents the best fit line in the dataset (N = 47, R2 = 0.71).

$$Rv = 0.05 + 0.9I_a$$

Where:

- Rv = Runoff coefficient
- I_a = Percent impervious area draining to the structure in decimal form

The Simple Method uses different impervious cover values for separate land uses within a subwatershed. Although representative impervious

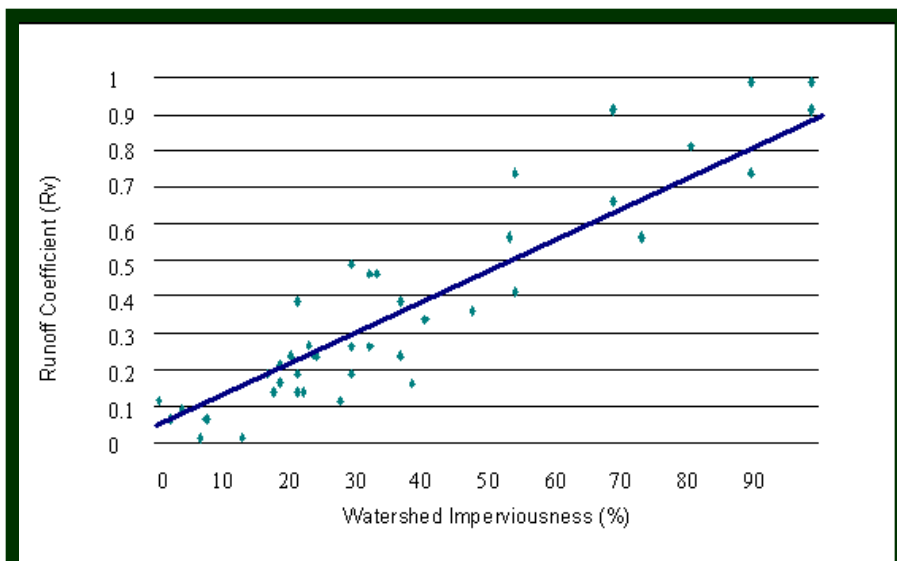


Figure 8-1. Relationship between watershed imperviousness (I) and the storm runoff coefficient (Rv) (Source: Adapted from Schueler, 1987).

cover data is available, DES recommends using impervious cover data specific to an individual project site. Towns may have detailed impervious cover information if they maintain a detailed land use/land cover GIS database, or impervious cover can be measured directly from the site or site plans. Subdivision plans typically do not include the exact size and location of the impervious cover associated with rooftops, driveways, and other impervious areas on

individual lots. These areas should be included in the Simple Method analysis by assigning an average house size and driveway length and width for each lot. In addition, the sub-drainage areas to which each lot drains should be estimated.

Limitations to the Simple Method

The Simple Method should provide reasonable estimates of changes in pollutant export resulting from development activities. However, the following should be kept in mind when applying this method:

- The Simple Method is most appropriate for assessing and comparing the relative stormflow pollutant load changes of different land use and stormwater management scenarios. The Simple Method provides estimates of pollutant export that are probably close to the “true” but unknown values for a development site, watershed, or subwatershed. However, it is very important not to over emphasize the precision of the results obtained. For example, it would be inappropriate to use the Simple Method to evaluate relatively similar development scenarios (e.g., 34.4% versus 36.9% impervious cover).
- The Simple Method provides a general planning estimate of likely pollutant export from areas at the scale of a development site, watershed, or subwatershed. More sophisticated modeling may be needed to analyze larger and more complex watersheds.
- The Simple Method only estimates pollutant loads generated during storm events and does not take into consideration background pollutants associated with baseflow volumes. Baseflow is typically

negligible at the scale of a single development site and can usually be safely neglected. However, watersheds and subwatersheds do generate baseflow pollutant loads. Baseflow pollutant loads usually make up only a small fraction of the total pollutant load delivered from a developed area. Still, it is important to remember that the load estimates refer only to storm event derived loads and should not be confused with the total pollutant load from an area.

8-2. Simple Method Input Data

This section discusses and provides or references the input data required to run the Simple Method analysis including a link to the Simple Method Spreadsheet, event mean concentrations for stormwater pollutants, stormwater BMP pollutant removal efficiencies, and precipitation data. Additional guidance on conducting pollutant loading analysis using the Simple Method is provided by NHDES.

Simple Method Spreadsheet

The Simple Method spreadsheet was developed by NHDES to calculate pre- and post-development pollutant loads using the Simple Method. The spreadsheet is in Microsoft Excel format and includes an instruction worksheet (“Instructions”), two data input worksheets (“Input_LU_A_Ia_C” and “Input BMPs”), a summary worksheet (“SUMMARY”), and worksheets for each pollutant showing pre- and post-pollutant loading (“ie, “Pre_TSS”, “Post_TSS”, “Pre_BOD”, etc.).

The “Input_LU_A_Ia_C” worksheet requires the input of general project information (e.g., date, project name, town, etc.) as well as the pre- and post-development conditions for each subwatershed, including the name of the subwatershed, the area (in acres), and the impervious fraction for each applicable land use in the subwatershed. The worksheet is set up for up to ten different subwatersheds; however, more can be added if necessary. After the pre- and post- construction information is entered, the pollutant concentrations for each applicable pollutant and land use should be entered for each subwatershed. This is the “C” value in the Simple Method equations, but it also known as the event mean concentration (EMC). A table of EMC values is included in the worksheet.

The “Input BMPs” worksheet is where descriptions and removal efficiencies of existing and proposed BMPs is entered. This information should be entered for the pre- and post-development condition for each subwatershed.

Once this information has been entered, the “SUMMARY” worksheet shows the total pre- and post-development loading results. The individual pre- and post- pollutant worksheets show the loads and removals for the individual subwatersheds. Additional information, instructions, and the Simple Method spreadsheet are available from NHDES.

Event Mean Concentrations of Stormwater Constituents

Appendix D shows the list of pollutants with their event mean concentration (EMC) values that should be included in pre- and post-development pollutant loading estimates. The project area can either be grouped into general land use types, such as residential, commercial, industrial, and roadway, or broken down into specific components such as residential roofs, commercial streets, or lawns, to calculate annual pollutant loads. It is important that the approach used to model the pre-condition is also used to model the post-condition. NHDES will consider other EMCs if requested by the applicant and if sufficient documentation is provided.

Best Management Practices (BMP) Pollutant Removal Efficiencies

If you are using the Simple Method, the pollutant removal efficiencies in Appendix E should be used. NHDES will consider other BMP removal efficiencies if requested and if sufficient documentation is provided.

Precipitation Data

In addition to the Simple Method, many other models for calculating pollutant loads require input of the average annual precipitation. Average annual precipitation for various towns and cities in New Hampshire for the period of 1971 – 2000 may be obtained from http://www.erh.noaa.gov/gyx/climo/NH_STATS_NEW.htm. The average annual precipitation value in inches for the community closest to your project should be used.

Chapter 8 References

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